

Accelerator Systems Division Highlights Ending August 29, 2003

ASD/LANL: Warm Linac

HIGH-POWER RF (WBS 1.4.1.1)

Accomplishments This Week: (1) *402.5-MHz E2V klystrons:* The heat run for S/N 8 is on hold while we test the 5-MW Thales tube. The factory acceptance test dates for S/N 7 have been delayed because of a vacuum leak. (2) *805-MHz, 5-MW Thales klystrons:* We finished the DC conditioning and are now RF conditioning this tube. We got up to 5.0 MW at a 600- μ sec HV pulse and a 50- μ sec RF pulse and ran for almost 1 hour until arcing occurred on the klystron window arc detector (see below). (3) *805-MHz, 550-kW CPI klystrons:* We received S/N 29, 30 and 31 at LANL. There was some shipping damage to the vac-ion connector on one tube, but the damage is fully repairable. We are working with CPI to resolve this. (4) *402.5-MHz RF windows:* The window testing is on hold until we finish testing the 805-MHz, 5-MW tube. (5) *SC transmitters:* We reviewed and gave final approval of factory acceptance test results and heat-run results for 805-MHz SC Transmitter S/N 8 at Titan.

Concerns & Actions: We continue to have arcing problems at the second window of the 5-MW Thales klystron. We installed another arc detector near the Kapton window, replaced the bellows with a straight section, and moved the air exit port closer to the Kapton window. We then conditioned up to 4.25-MW RF and shut down for the night. The next day at 2.0 MW we got arcing. We vented and then re-filled with SF₆. Arcing occurred at 3.5 MW initially and lower power levels subsequently. We are investigating possible causes for the arcing.

HIGH-VOLTAGE POWER CONDITIONING (WBS 1.4.1.2)

Accomplishments: (1) *Operations:* We supported the 5-MW klystron testing to full peak power at 1/2 maximum average power using the prototype HVCM. (2) *SCR controller repair:* We cleaned the smoke damage from the #1 SCR controller that failed last week. We then worked with a visiting Dynapower engineer to diagnose the triggering problem in this controller. We found a SCR that failed open because of gate drive failure, which may have been the root cause for all the recent SCR problems in this unit. After replacing the gate drive, we successfully ran this SCR controller at +/- 800 VDC and 250 ADC without any sign of instability. We then used it to successfully run the production HVCM at 120 kV, 35 A, 1.38-ms pulse width at 60 Hz for 1/2 hour. As of today, we now have two working HVCMs for the LANL test program. (3) *HVCM controls:* We began working with the controls group to upgrade the EPICS-HVCM system interface to address previously identified deficiencies in remote control screens. These changes make the remote interface more user friendly to reduce operator frustration and the chance of improper operation that could cause damage to equipment. We also worked with the HVCM control-rack manufacturer to communicate with the prototype IGBT control chassis via computer interface.

DRIFT-TUBE LINAC (WBS 1.4.2)

Accomplishments— Tank 2: (1) Group J water-channel final internal cavity machining (magnet “clocking” pins) is underway; scheduled for magnet installation on Sep. 2. Cap welding of group J will also commence on Sep. 2. All Tank-2 water-channel welds are complete. Groups L, M and half of group K have been stress relieved; balance of group K will be stress relieved Sep. 3. (2) Waveguide final brazing is complete and the unit shipped to CMI for final machining. Projected date for shipping of waveguide is Sep. 17.

Tank 4: Final profiling is underway on groups A, B and C at CMI. The welding for group D is complete except for the last three units because of a welding machine failure. Stem rework for Tanks 4-6 is complete.

Tank 5: Water-channel weld repairs and cap welds are on hold because of welding machine failure and personnel availability. Welding is expected to resume Sep. 8.

Tank 6: (1) All drift tubes are ready for weld repairs and cap welds; in queue at Hanford behind Tank-5 drift tubes; welding is expected to start Sep. 15 and finish Sep. 19. (2) Tank-6 waveguide is currently undergoing final brazing (last scheduled furnace brazing operation at Los Alamos) and will ship to CMI for final machining by Sep. 2. Projected date for shipping waveguide to ORNL is Sep. 25.

Tank 3: Waveguide final brazing is complete and the unit shipped to CMI for final machining. Projected date for shipping of waveguide to ORNL is Oct. 6.

EMD and BPM drift tubes: EMD drift tubes for Tanks 2, 5 and 6 are scheduled to ship to Sciaky this week (EMD units for tanks 1, 3 and 4 are already there). The next episode of welding is scheduled to begin on Sep. 8. Welding of BPM drift-tubes end caps and beam tubes is scheduled to commence on Sep. 10. Production ordering was changed to give priority for EMDs and BPMs for Tanks 1, 2 and 3.

Beam boxes and inter-tank hardware: Box 3/4 is now at LANL, with arrangements being made for leak checking. The inventory of inter-tank hardware is almost complete; there are a few missing items that we are looking for (beam box view ports) or need to order (retaining rings).

Concerns & Actions: (1) Discussions are underway with ESCO to gain schedule on Tank-2 drift tubes. The welding delay at Hanford is adding delay to Tanks 4, 5 and 6 schedules; we are considering moving welding work from Hanford to ESCO if Hanford performance continues to lag.

COUPLED CAVITY LINAC (WBS 1.4.4)

Accomplishments: (1) The CCL tuning continues at ACCEL with frequency measurements of all bridge couplers and end coupling cells in couplers 1 through 10 completed. This is in preparation for nose machining to place the frequency of all cells to the high side of 805.12 MHz. We will machine the tuning screw feature into coupling cell noses and proceed into coupling cell tuning next week. (2) Jim Billen and Jim Stovall will be at ACCEL next week and the following week to provide guidance and assistance in the tuning process.

PHYSICS & DIAGNOSTICS (WBS 1.4.5)

Accomplishments: (1) *BPM pickups:* The final weld step underway on the BPM drift tubes. Assuming this is successful, we will install the cables, map the pickups, and complete the documentation for these units, completing all BPM pickup deliverables. (2) *BPM electronics:* The fixes to the 805-MHz AFEs reported last week were successful, and all AFEs are now operating well. We modified the software on the BPM electronics to fix a startup bug that had required operator intervention during the turn-on phase. (3) *WS electronics:* We completed the front and back panels for 26 (of the 36 remaining) driver chassis. All 36 National Instruments stepper-motor drivers for these chassis are on order. Testing will begin next week on the linac and HEBT WS electronics. (4) *Energy degrader/Faraday cups:* The five remaining ED/FC assemblies are being assembled at the vendor IMC in Albuquerque. Ninety-five percent of the parts are on hand, and scheduled delivery date to LANL is Sep 30. This should meet the required ORNL delivery dates. (5) *Harps:* First articles of the wire crimps were received and tested satisfactorily; the remainder needed have been ordered. We are 50% complete on the harp mechanical drawing package.

Concerns & Actions: We are still seeing failures of the BPM DFE circuits that appear to be related to the last production run of circuit boards. We have brought four BPM electronics units that exhibit this problem back to LANL to be diagnosed and fixed. We will have ORNL ship back the four unused PC chassis to LANL so we can fix and test the entire systems before returning them to ORNL. There are enough of the old-design and new-design BPM units remaining at ORNL to support commissioning of DTL-1.

ASD/JLAB: Cold Linac

The 1 MW RF test stand repair is thought to be complete, but first operation is now scheduled for Sept. 3, after the holiday and a one-day safety review of activities planned for the CEBAF September shutdown.

Cryomodule M-5 has cooled down. Testing of tuners is underway.

Alignment and attachment of end cans to M-6 continues.

The M-7 string has been assembled and is under vacuum. (See photo).

One cavity is qualified for the M-8 string.

HB02, HB04 and HB06 have been electropolished.



ASD/BNL: Ring

Congratulations to the SNS/OR Team on achieving first beam through DTL#1 this past week. Continued success!

BCM efforts: P. Cameron reported that his group's focus has been on "the mysterious electronics failure problem which seems to be specific to operation of BCM electronics at ORNL. No failures have been observed during many months of testing at BNL, and no failures were observed during initial MEBT commissioning at LBNL. Promising candidate for failure mechanism was proposed by Jim Pogue, but fairly exhaustive wringing out of the Dattel power supply in the lab here at BNL has pretty much eliminated this power supply oscillation theory. We remain without insight into the ORNL-specific failure mechanism. Just the same, we ordered two 15 watt Dattel power supplies (pin compatible with the present 9 watt supplies) for evaluation. We are going ahead with stuffing of 10 of the 30 'final' BCM AFE boards. These boards have additional input protection."

A change order was issued to BINP to fabricate bus bars and mounting support blocks for the twenty-four quadrupoles that Budker is building for SNS.

An Engineering Review of the extraction Lamberson septum magnet was presented by Jim Rank to ASD on 8/27/03. Among other things, it was agreed that Jim will look to see if he can reduce the "length" of the present cooling water path by dividing flow into additional parallel circuits as suggested by T. Hunter (including associated plumbing, wiring and jumpers). Meeting notes will be circulated next week.

Dave Gassner and Yongbin Leng are at SNS/OR this week to support ASD in commissioning of DTL1.

NETC shipped four (4) 27CDM30 magnets to SNS/OR; winding configurations are two vertical and two horizontal.

36CDR30 (rad hard correctors) – four coils for one magnet are now wound.

Approval from AP Group – "...moving the last two quadrupoles in the RTBT line by up to 50 cm will improve crucial beam size measurements to be made with the RTBT target harp. To accommodate this movement, the quad power supplies must provide 10% more current. Please add this additional 10% PS capacity."

Preparations are underway for delivery of half-cell #12 to SNS/OR. Shipment is scheduled for Tuesday, Sept. 2nd.

Controls

The controls team was actively involved in preparing for the first beam into the first DTL module this week, and several members were present in the control room on Thursday to participate in the celebrations.

Two colleagues from LANL joined us this week. Although Pilar Marroquin was here primarily to work on integration of the Residual Gas Analyzer and Martin Pieck on the CCL Quadrupole power supply controls, both

were called on to help with beam preparation issues, and both contributed to the final success. Also visiting this week was Yury Eidelman of the BNL controls team, who was in the control room working on the alarm handler at the moment of first beam. Yury was the only person present with a camera – his pictures will be those for posterity. We are arranging for more team members from LANL to spend time at ORNL during the DTL run to supplement controls team support.

Calibration of the Central Helium Liquefier gas storage tanks pressure transmitters was performed. Two of the pressure transmitters did not read within the required accuracy band and will be removed for adjustment in the shop. Two other transmitters barely read within the required accuracy band and will also be adjusted in the shop. All four of these transmitters will be rechecked prior to use.

Installation was completed on the standalone Oxygen Deficiency Hazard (ODH) unit for the recovery compressor in the warm compressor area. The system will be tested next week. The CHL control room rack drawings were reviewed prior to submitting for approval. The rack drawing package will be ready for signatures next week. Electricians have been assigned to the installation of the permanent ODH system for the CHL. The installation crew is planning the job and actual installation of wiring and wireways will start next week.

Field installation for Personnel Protection System (PPS) Phase 1 equipment is continuing. All of the Beam Shutdown Stations (BSSs) have been installed in the tunnel. Cable pulls to the Beam Shutdown Stations are 50% complete. Wiring terminations are being completed in the first Klystron PLC cabinet. The Phase 1 PLC rack design package was signed and issued to the DCC. A prototype RF interface to the PPS is being built. This one will handle six amplifiers that are contained in a four rack gang.

At BNL, the first Yokogawa function generator/digitizer was interfaced with EPICS. EPICS screens were modeled after the screens used in the Windows software provided by Yokogawa. Function generator control includes arbitrary waveform specification (via data points read from a file), as well as built in functions. The built in functions are not needed for injection painting, but are useful for system development and testing. Waveform readbacks via the digitizer modules have been successfully tested at 10Hz. A purchase order has been placed for the remaining seven Yokogawa units, along with the sole-source justification. It was not possible to complete the RGA driver this week. The driver in the field did not behave as the one at LANL. The one in the field was a later version and is fully operational. Further progress will require access to a fully functional test stand.

Testing will proceed at LANL on the new Low-Level RF Field Control Module (LLRF FCM) when a module can be obtained from ORNL. Meanwhile, the High Power Protect Module (HPM) is being tested at the test stand newly set up at ORNL, and modifications have been made for the latest release of the modulator control software.

An EPICS test stand has been installed for the magnet lab, and ramping and conversions have been added to the MEBT magnet software.

The warm vacuum documentation has been placed by LANL into the ORNL configuration management system, and is ready for review. The format modifications have made for a clearer document.

The JAVA scope tool is being stress tested at LANL and is not meeting the 60 Hz x 3 channels x 1024 data point specification. It should nonetheless meet the commissioning requirements at 10 Hz.

Installation

Craft Snapshot 8/26/03

ASD craft workers	66.0
Foremen, ES&H, etc	12.0
Less WBS 1.9 etc	11.0
Less absent	3.0
TOTAL	64.0

Accelerator Physics

Operations Group

The Operations Group, with the Physics and Technical Groups, prepared for and successfully passed the Aug 12-14 DTL tank #1 Accelerator Readiness Review. The resulting punch list of action items were cleared with DOE signoff at noon Tuesday Aug 26.

First 7.5 MeV beam was accelerated through tank #1 at 2 pm Thursday Aug 28.

Ion Source Group

On Wednesday the Front End 2 MHz matching network failed shortly before midnight. It took roughly one hour to repair it, with about half of the time spent on ESP LOTO on the BBB. It took almost another hour for controls to reconfigure the IOC that failed due to being knocked out by the ESP LOTO.

The Front End 13 MHz RF system failed Friday evening. To keep the plasma lit without the 13 MHz required a five time higher rep rate, twice the pressure, and about 30% more 2 MHz power than before. This is consistent with the new source being significantly cleaner than the source used in January when the 13 MHz had only a marginal effect on the operation.

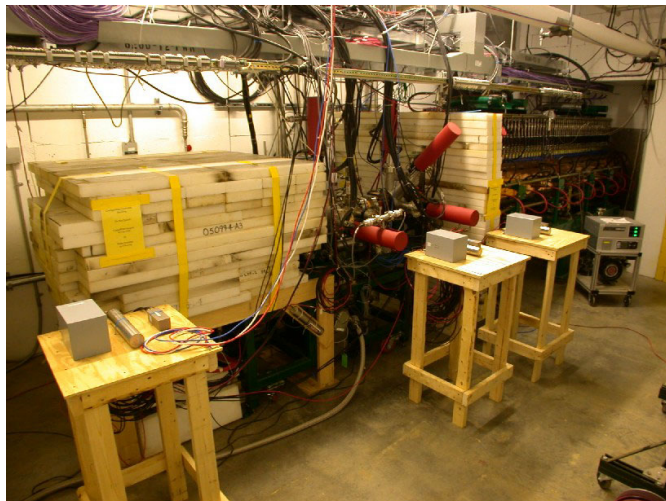
As such operational parameters significantly degrade source lifetime, the 13 MHz RF system was replaced with the hot spare system from the Hot Spare Stand. In less than two hours the source was back up and running with the usual parameter settings.

An emergency shut off button has been installed out side the Hot Spare Stand cage in preparation for unattended operations required for realistic life time tests.

Survey and Alignment

Mechanical Group

The ARR committee gave the go ahead for DTL-1 commissioning activities to begin on August 26, 2003. The first beam passed through DTL-1 on the afternoon of August 28, 2003.



DTL-1 and D-plate in Final Commissioning Configuration

DTL-2 tank segments have been assembled in the FE building. The tank will now be blanked off in preparation for leak testing.



DTL-2 Tank Segment Assembly in the FE Building

RING Systems Installation activities

- Assembly of the HEBT beamline diagnostic and drift pipe supports was completed.
- Drilling and mounting of the balance of HEBT beamline supports was completed.
- Assembly of HEBT pump support stands and installation of 2 ion pumps was completed.
- Cable pulling from the Ring Service Building to the HEBT continued.
- Cable tray installation in the RING Service Building continued.
- Buss bar interconnection installation in the RING continued.

Magnet Task

We measured CCL Quadrupoles. We now have a total of seven measured, Two of these have been shipped to LANL for insertion of beam tubes and associated devices.

We are also working on the 21Q40/27CD measurement system.

We have received four more 27CD30's from NETC. A total of nine 27CD30's are here.

Electrical Group

Power Supplies

The vendor to the CCL power supplies has agreed to supply retrofit water flow switches to solve the faulty over temperature interlock problems with these supplies.

Ten more SCL power supplies were delivered this week, bring the total delivered to 26 (of 42)

Modulator

Operation of the RFTF HVCM this week with the following parameters:

- Vcathode -- 107 kV
- Pulse width -- 1 ms
- Rep rate -- 60 Hz
- Average power -- 200 kW

The modulator has been turned over to the RF group for testing of the CPI tube next week. After this is complete, we will begin switching loss characterization on the unit and start the R&D program in earnest.

DTL ME1 is operating in support of DTL 1 commissioning

DTL ME2 and 3 are operational and turned over to the RF group for system integration.

CCL ME1 installation is complete and checkout will begin next week

Installation

Linac SCL-ME1 modulator HV cable pulled and terminated

Linac cable tray installation in SCL-ME2 completed

Linac Quad cable up to chase 33 completed (SCL module 2)

Ring SB to HEBT past the ground break Quad and Bend pulls completed

Main dipole bus tie to the duct bank dc bus installed (looks really good, special thanks to Ray Savino and Arnold DeCarlo)

All main tray marking completed for cable pulls commencing next week.

HPRF

Turned DTL3 RF Station & ME2 HVCM systems over to Operations Monday.

Completed last water and electrical connections to RF Waveguide components in the RFTF. Brought 402 MHz and 805 MHz transmitters to "Rdy for HV" state. HVCM used "beamstick" in klystron HV tank as a test load and operated successfully.

LLRF

Cryosystem Group

CHL: Work continues on the following items: 2.1K cold box piping, End can to transfer line assembly, purging the absorbers of the purifier, Alignment of the warm compressor oil pumps.

Tunnel: Work continues on the orbital welding of the transfer line helium purge tubing.

RATS: Work continues on the assembly of the transfer line "U" tube sub assemblies. We are packing up equipment to move over to building 8550 at the site. The move will take place in late September.

Beam Diagnostics